CLAIMS

1. (Amended) A method for driving a liquid crystal device including a first transparent substrate and a second transparent substrate that face each other, a liquid crystal filled between the first and second transparent substrates, a first transparent electrode formed on a surface of the first transparent substrate that faces the second transparent substrate, and a second transparent electrode formed on a surface of the second transparent substrate that faces the first transparent substrate, the method comprising the steps of:

applying a first driving signal of a square-wave voltage to the first transparent electrode and applying a second driving signal of a square-wave voltage to the second transparent electrode;

where the first driving signal has a voltage amplitude V1, a frequency F1, and a duty ratio D1, the second driving signal has a voltage amplitude V2, a frequency F2, and a duty ratio D2, and a phase difference between the first driving signal and the second driving signal is indicated by ϕ,

adjusting V1 and V2 so that a refractive index ΔN of the liquid crystal changes in a substantially linear range relative to ϕ; and

controlling the refractive index ΔN of the liquid crystal by adjusting the phase difference ϕ in a state where V1 = V2, F1 = F2, and D1 = D2 so as to vary an effective voltage to be applied to the liquid crystal.

2. (Cancelled)

3. A method for driving a liquid crystal device according to claim 1, wherein the liquid crystal device is disposed on an optical path between a light source of an optical head and a recording surface of an optical disk, the optical head emitting a light beam from the light source onto a land and a groove that are formed on and in the recording surface and detecting reflected light from the land and the groove; and the refractive index of the liquid crystal of the liquid crystal device is controlled to compensate for an optical phase difference generated between the reflected light from the land and the reflected light from the groove.

4. (Amended) An apparatus for driving a liquid crystal device including a first transparent substrate and a second transparent substrate that face each other, a liquid crystal filled between the first and second transparent substrates, a first transparent electrode formed on a surface of the first transparent substrate that faces the second transparent substrate, and a second transparent electrode formed on a surface of the second transparent substrate that faces the first transparent substrate, the apparatus

comprising:

voltage application means for applying a first driving signal of a square-wave voltage to the first transparent electrode and applying a second driving signal of a square-wave voltage to the second transparent electrode; and

control means for, where the first driving signal has a voltage amplitude V1, a frequency F1, and a duty ratio D1, the second driving signal has a voltage amplitude V2, a frequency F2, and a duty ratio D2, and a phase difference between the first driving signal and the second driving signal is indicated by ϕ, adjusting V1 and V2 so that a refractive index ΔN of the liquid crystal changes substantially linearly relative to ϕ and controlling the refractive index ΔN of the liquid crystal by adjusting the phase difference ϕ in a state where V1 = V2, F1 = F2, and D1 = D2 so as to vary an effective voltage to be applied to the liquid crystal.

5. (Cancelled)

6. An apparatus for driving a liquid crystal device according to claim 4, wherein the liquid crystal device is disposed between a light source of an optical head and a

recording surface of an optical disk, the optical head emitting a light beam from the light source onto a land and a groove that are formed on and in the recording surface and detecting reflected light from the land and the groove; and the refractive index of the liquid crystal of the liquid crystal device is adjusted to compensate for an optical phase difference generated between the reflected light from the land and the reflected light from the groove.

7. A liquid crystal device comprising a first transparent substrate and a second transparent substrate that face each other, a liquid crystal filled between the first and second transparent substrates, a first transparent electrode formed on a surface of the first transparent substrate that faces the second transparent substrate, and a second transparent electrode formed on a surface of the second transparent substrate that faces the first transparent substrate, the first and second transparent electrodes forming planes that extend in parallel to each other with a spacing therebetween,

wherein the first transparent electrode includes a first annular electrode portion, a second round electrode portion formed in the first electrode portion, and a third electrode portion formed around the first electrode portion;

the second transparent electrode includes a fourth annular electrode portion, a fifth round electrode portion formed in the fourth electrode portion, and a sixth

electrode portion formed around the fourth electrode portion;

the first and fourth electrode portions have the same annular shape, and the second and fifth electrode portions have the same round shape; and

the first and second transparent electrodes are disposed so that there is a spacing between a first axis and a second axis, the first axis extending through the center of the first electrode portion and being orthogonal to the first transparent electrode, the second axis extending through the center of the fourth electrode portion and being orthogonal to the second transparent electrode.

8. A liquid crystal device according to claim 7, wherein the first electrode portion faces the fourth, fifth, and sixth electrode portions with the liquid crystal disposed therebetween; the second electrode portion faces the fourth and fifth electrode portions with the liquid crystal disposed therebetween; and the third electrode portion faces the fifth and sixth electrode portions with the liquid crystal disposed therebetween.

9. A liquid crystal device according to claim 7, wherein the liquid crystal device is disposed on an optical path between a light source of an optical head and a recording surface of an optical disk, the optical head emitting a light beam from the light source onto the recording surface

and detecting reflected light from the recording surface; and a refractive index of the liquid crystal of the liquid crystal device is adjusted to compensate for a spatial optical phase difference of the reflected light generated on the optical disk due to an angle, or a tilt, between the light beam emitted from the optical head onto the recording surface and an axis orthogonal to the recording surface.

10. A liquid crystal device according to claim 9, wherein the light beam emitted from the optical head onto the recording surface and the axis orthogonal to the recording surface are included in a plane including the first axis and the second axis.

11. A liquid crystal device according to claim 9, wherein an outer diameter of each of the first and fourth electrode portions is greater than an outer diameter of a beam spot of a light beam that passes through the first and second transparent electrodes, and an outer diameter of each of the second and fifth electrode portions is smaller than the outer diameter of the beam spot of the light beam that passes through the first and second transparent electrodes.

12. A method for driving a liquid crystal device including a first transparent substrate and a second transparent substrate that face each other, a liquid crystal filled between the first and second transparent substrates, a first transparent electrode formed on a surface of the first

transparent substrate that faces the second transparent substrate, and a second transparent electrode formed on a surface of the second transparent substrate that faces the first transparent substrate, the first and second transparent electrodes forming planes that extend in parallel to each other with a spacing therebetween, the first transparent electrode having a first annular electrode portion, a second round electrode portion formed in the first electrode portion, and a third electrode portion formed around the first electrode portion, the second transparent electrode having a fourth annular electrode portion, a fifth round electrode portion formed in the fourth electrode portion, and a sixth electrode portion formed around the fourth electrode portion, the first and fourth electrode portions having the same annular shape, the second and fifth electrode portions having the same round shape, the method comprising the steps of:

applying a first driving signal of a square-wave voltage to the first electrode portion;

applying a second driving signal of a square-wave voltage to the second and third electrode portions;

applying a third driving signal of a square-wave voltage to the fourth electrode portion;

applying a fourth driving signal of a square-wave voltage to the fifth and sixth electrode portions; and

where a phase difference between the first driving signal and the third driving signal is indicated by $\phi 1$, a phase difference between the first driving signal and the second driving signal is indicated by $\phi 2$, and a phase difference between the third driving signal and the fourth driving signal is indicated by $\phi 3$,

controlling a refractive index of the liquid crystal disposed between the first transparent electrode and the second transparent electrode by fixing the phase difference $\phi 1$ and adjusting the phase difference $\phi 2$ and the phase difference $\phi 3$ by an identical phase amount in a state where the first to fourth driving signals have the same voltage amplitude, frequency, and duty ratio, so as to vary an effective voltage to be applied to the liquid crystal.

13. A method for driving a liquid crystal device according to claim 12, wherein the liquid crystal disposed between the first transparent electrode and the second transparent electrode has a first liquid crystal portion to which the first driving signal and the third driving signal are applied, a second liquid crystal portion to which the first driving signal and the fourth driving signal are applied, a third liquid crystal portion to which the second driving signal and the third driving signal are applied, and a fourth liquid crystal portion to which the second driving signal and the fourth driving signal are applied; and the

refractive index of the liquid crystal disposed between the first transparent electrode and the second transparent electrode is controlled independently for the first to fourth liquid crystal portions.

14. A method for driving a liquid crystal device according to claim 12, wherein the voltage amplitudes of the first to fourth driving signals are adjusted so that the refractive index of the liquid crystal substantially linear changes relative to a change of the phase differences $\phi 2$ and $\phi 3$.

15. An apparatus for driving a liquid crystal device including a first transparent substrate and a second transparent substrate that face each other, a liquid crystal filled between the first and second transparent substrates, a first transparent electrode formed on a surface of the first transparent substrate that faces the second transparent substrate, and a second transparent electrode formed on a surface of the second transparent substrate that faces the first transparent substrate, the first and second transparent electrodes forming planes that extend in parallel to each other with a spacing therebetween, the first transparent electrode having a first annular electrode portion, a second round electrode portion formed in the first electrode portion, and a third electrode portion formed around the first electrode portion, the second transparent electrode having a fourth annular electrode

portion, a fifth round electrode portion formed in the fourth electrode portion, and a sixth electrode portion formed around the fourth electrode portion, the first and fourth electrode portions having the same annular shape, the second and fifth electrode portions having the same round shape, the apparatus comprising:

voltage application means for applying a first driving signal of a square-wave voltage to the first electrode portion, applying a second driving signal of a square-wave voltage to the second and third electrode portions, applying a third driving signal of a square-wave voltage to the fourth electrode portion, and applying a fourth driving signal of a square-wave voltage to the fifth and sixth electrode portions; and

control means for, where a phase difference between the first driving signal and the third driving signal is indicated by $\phi 1$, a phase difference between the first driving signal and the second driving signal is indicated by $\phi 2$, and a phase difference between the third driving signal and the fourth driving signal is indicated by $\phi 3$, controlling a refractive index of the liquid crystal disposed between the first transparent electrode and the second transparent electrode by fixing the phase difference $\phi 1$ and adjusting the phase difference $\phi 2$ and the phase difference $\phi 3$ by an identical phase amount in a state where

the first to fourth driving signals have the same voltage amplitude, frequency, and duty ratio, so as to vary an effective voltage to be applied to the liquid crystal.

16. An apparatus for apparatus a liquid crystal device according to claim 15, wherein the liquid crystal disposed between the first transparent electrode and the second transparent electrode has a first liquid crystal portion to which the first driving signal and the third driving signal are applied, a second liquid crystal portion to which the first driving signal and the fourth driving signal are applied, a third liquid crystal portion to which the second driving signal and the third driving signal are applied, and a fourth liquid crystal portion to which the second driving signal and the fourth driving signal are applied; and the control means independently controls the refractive index of the liquid crystal disposed between the first transparent electrode and the second transparent electrode for the first to fourth liquid crystal portions.

17. An apparatus for driving a liquid crystal device according to claim 15, wherein the voltage amplitudes of the first to fourth driving signals are adjusted so that the refractive index of the liquid crystal substantially linear changes relative to a change of the phase differences $\phi 2$ and $\phi 3$.